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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 February 2001 (15.02.2001)

PCT

(10) International Publication Number
WO 01/11004 A1

(51) International Patent Classification[7]: C11D 17/04, 3/18, 7/24, A47L 13/17

(21) International Application Number: PCT/US00/21895

(22) International Filing Date: 10 August 2000 (10.08.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/148,261 11 August 1999 (11.08.1999) US

(71) Applicant: THE PROCTER & GAMBLE COMPANY [US/US]; One Procter & Gamble Plaza, Cincinnati, OH 45202 (US).

(72) Inventors: KACHER, Mark, Leslie; 9731 Montclaire Drive, Mason, OH 45040 (US). MAILE, Michael, Stephen; 2870 Mossybrink Court, Maineville, OH 45039 (US). WILLMAN, Kenneth, William; 5603 Williamsburg Way, Fairfield, OH 45014 (US). POLICICCHIO, Nicola, John; 4976 Laurelwood Court, Mason, OH 45040 (US). RUSSO, Paul, Joseph; 9667 Tulip Tree Court, Loveland, OH 45140 (US). METZGER, Jerome, Lee; 6233 Fox Run Lane, Florence, KY 41042 (US).

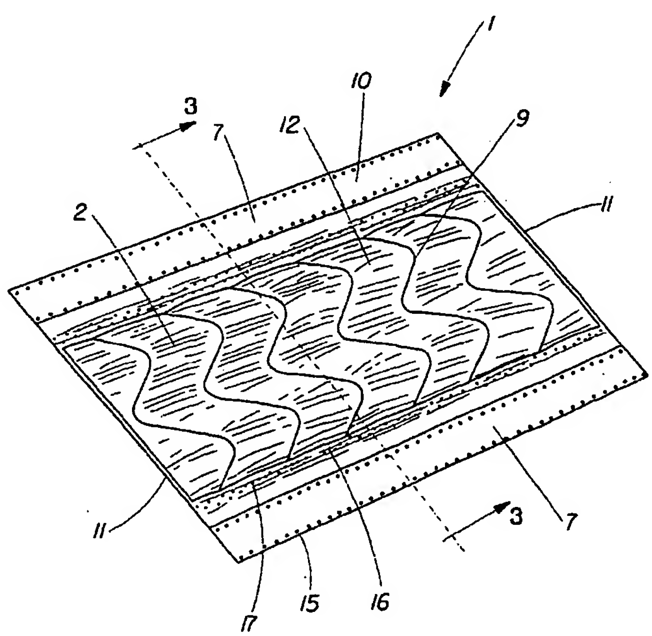
(74) Agents: REED, T., David et al.; The Procter & Gamble Company, 5299 Spring Grove Avenue, Cincinnati, OH 45217-1087 (US).

(81) Designated States *(national)*: AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KR (utility model), KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European

[Continued on next page]

(54) Title: CLEANING SHEETS TO MINIMIZE RESIDUE LEFT ON SURFACES



(57) Abstract: Cleaning sheets comprise an additive that is selected to enhance the pick up and retention of particulate material from surfaces, while minimizing the amount of residue left on the surface being cleaned. If the type of additive and level of additive on the cleaning sheet are not carefully selected, the sheet will leave a residue on the surface being cleaned resulting in filming and streaking of the surface that is unacceptable to consumers. The additive is preferably selected from the group consisting of a wax, an oil, and mixtures thereof.

WO 01/11004 A1

patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

CLEANING SHEETS TO MINIMIZE RESIDUE LEFT ON SURFACES

TECHNICAL FIELD

The present invention relates to cleaning sheets particularly suitable for removal and entrapment of dust, lint, hair, sand, food crumbs, grass and the like.

BACKGROUND OF THE INVENTION

The use of nonwoven sheets for dry dust-type cleaning are known in the art. Such sheets typically utilize a composite of fibers where the fibers are bonded via adhesive, entangling or other forces. See, for example, U.S. Patent No. 3,629,047 and U.S. Patent 5,144,729. To provide a durable wiping sheet, reinforcement means have been combined with the staple fibers in the form of a continuous filament or network structure. See, for example, U.S. Patent No. 4,808,467, U.S. Patent 3,494,821 and U.S. Patent No. 4,144,370. Also, to provide a product capable of withstanding the rigors of the wiping process, prior nonwoven sheets have employed strongly bonded fibers via one or more of the forces mentioned above. Such a cleaning sheet is described in European patent applications EP 774,229 A2 and EP 777,997 A2, which utilize continuous filaments bonded to a base sheet via heat-seal lines. While durable materials can be obtained, such strong bonding may adversely impact the materials' ability to pick up and retain particulate dirt. In an effort to address this concern, an additive consisting of mineral oil has been applied to such cleaning sheets at relatively high levels (i.e. greater than 5% by weight of the cleaning sheet). However, a mineral oil additive, when applied to such cleaning sheets at such high levels, tends to leave an unappealing residue on surfaces that are wiped with such cleaning sheets which is unacceptable to consumers.

U.S. Patent No. 5,599,550 issued February 4, 1997 to Kohlruss et al. describes a biodegradable wax-impregnated dust cloth. However, the dust cloth disclosed by Kohlruss utilizes natural fibers and relatively high levels of wax, both of which contribute to eliminating the electrostatic properties of the dust cloth.

It has thus been a desire of those skilled in the art to develop a cleaning sheet that has an ability to effectively pick up and retain particulate dirt, while maintaining the electrostatic properties of the cleaning sheet and minimizing the amount of residue left on the surface being wiped with such cleaning sheet. It has further been desired to develop a cleaning method that improves the cleaning performance of cleaning sheets.

SUMMARY OF THE INVENTION

The present invention relates to a cleaning sheet for removing and retaining particulate material such as dust, lint, hair, sand, food crumbs, grass and the like from surfaces, while minimizing the amount of residue left on the surface after being wiped with the cleaning sheet. The present cleaning sheets comprise an additive, whereby the type and level of additive is selected such that the ability of the cleaning sheet to pick-up and retain particulate material is improved, while the residue left on the surface is minimized. The additive is preferably selected from the group consisting of a wax, an oil, and mixtures thereof. A preferred additive is a mixture of a wax and an oil, although a wax only additive or an oil only additive can be used.

The cleaning sheets of the present invention typically have a total aggregate basis weight of at least about 20 g/m^2, preferably at least about 40 g/m^2, and more preferably at least about 60 g/m^2. The total aggregate basis weight of the present cleaning sheets is typically no greater than about 275 g/m^2, preferably no greater than about 200 g/m^2, and more preferably no greater than about 150 g/m^2.

The cleaning sheets of the present invention can be made using either a woven or nonwoven process, or by forming operations using melted materials laid down on forms, especially in belts, and/or by forming operations involving mechanical actions/modifications carried out on films. The structures are made by any number of methods (e.g., spunbonded, meltblown, resin bonded, heat-bonded, air-through bonded, etc.), once the desired characteristics are known. However, the preferred structures are nonwoven, and especially those formed by hydroentanglement and/or heat-bonding as is well known in the art, since they provide highly desirable open structures. Therefore, preferred cleaning sheets are nonwoven structures having the characteristics described herein. Materials particularly suitable for forming the preferred nonwoven cleaning sheet of the present invention include, for example, synthetics such as polyolefins (e.g., polyethylene and polypropylene), polyesters, polyamides, and blends thereof. Also useful are natural fibers, such as natural cellulosics like cotton or blends thereof and those derived from various cellulosic sources such as synthetic cellulosics (e.g., RAYON®), however these are not preferred. Preferred starting materials for making the cleaning sheets of the present invention are synthetic materials, which may be in the form of carded, spunbonded, meltblown, airlaid, or other structures. Cleaning sheets comprising synthetic materials or fibers typically have desirable electrostatic properties,

which is preferred. Particularly preferred are polyesters, especially carded polyester fibers. The degree of hydrophobicity or hydrophilicity of the fibers is optimized depending upon the desired goal of the sheet, either in terms of type of soil to be removed, the type of additive that is provided, biodegradability, availability, and combinations of such considerations. In general, the more biodegradable materials are hydrophilic, but the more effective materials tend to be hydrophobic.

The present invention also encompasses cleaning implements comprising a handle and the present cleaning sheets.

The present invention further relates to improved cleaning methods comprising a "stamping" step and articles containing informational indicia to communicate such methods.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view showing a first embodiment of a heat-bonded cleaning sheet of the present invention.

FIG. 2 is a sectional view taken along a line III-III in **FIG. 1**.

FIG. 3 is a perspective view showing a second embodiment of the cleaning sheet being different from the embodiment shown by **FIG. 1**.

FIG. 4 is a perspective view showing a third embodiment of the cleaning sheet being also different from the embodiment shown by **FIG. 1**.

FIG. 5 is a digital photograph of a perspective view showing a fourth embodiment of the cleaning sheet which comprises brushy filaments.

FIG. 6 is a diagram illustrating a process for making a cleaning sheet as shown in **FIG. 5**.

FIG. 7 is a photograph (12x magnification) of a hydroentangled cleaning sheet of the present invention, which depicts a high basis weight continuous region and a plurality of low basis weight discrete regions.

FIG. 8 is a plan view of the hydroentangled cleaning sheet depicted in **FIG. 7**, to facilitate discussion of the basis weight differences of the sheet.

DETAILED DESCRIPTION OF THE INVENTION

I. Definitions

As used herein, the term "comprising" means that the various components, ingredients, or steps, can be conjointly employed in practicing the present invention. Accordingly, the term "comprising" encompasses the more restrictive terms "consisting essentially of" and "consisting of".

As used herein, the term "hydroentanglement" means generally a process for making a material wherein a layer of loose fibrous material (e.g., polyester) is supported on an apertured patterning member and is subjected to water pressure differentials sufficiently great to cause the individual fibers to entangle mechanically to provide a fabric. The apertured patterning member may be formed, e.g., from a woven screen, a perforated metal plate, etc.

As used herein, the term "Z-dimension" refers to the dimension orthogonal to the length and width of the cleaning sheet of the present invention, or a component thereof. The Z-dimension usually corresponds to the thickness of the sheet.

As used herein, the term "X-Y dimension" refers to the plane orthogonal to the thickness of the cleaning sheet, or a component thereof. The X and Y dimensions usually correspond to the length and width, respectively, of the sheet or a sheet component.

As used herein, the term "layer" refers to a member or component of a cleaning sheet whose primary dimension is X-Y, i.e., along its length and width. It should be understood that the term layer is not necessarily limited to single layers or sheets of material. Thus the layer can comprise laminates or combinations of several sheets or webs of the requisite type of materials. Accordingly, the term "layer" includes the terms "layers" and "layered."

For purposes of the present invention, an "upper" layer of a cleaning sheet is a layer that is relatively further away from the surface that is to be cleaned (i.e., in the implement context, relatively closer to the implement handle during use). The term "lower" layer conversely means a layer of a cleaning sheet that is relatively closer to the surface that is to be cleaned (i.e., in the implement context, relatively further away from the implement handle during use).

As used herein, the term "total aggregate basis weight" refers to the average basis weight of an entire cleaning sheet, when viewed as a whole sheet.

All percentages, ratios and proportions used herein are by weight unless otherwise specified. All references cited are incorporated herein by reference unless otherwise stated.

II. Cleaning Sheet

The present invention encompasses cleaning sheets comprising an additive that is selected to enhance the pick up and retention of particulate material from surfaces, while minimizing the amount of residue left on the surface being cleaned. If the type of additive and level of additive on the cleaning sheet are not carefully selected, the sheet will leave a residue on the surface being cleaned resulting in filming and streaking of the surface that is unacceptable to consumers.

The cleaning sheets of the present invention typically have a total aggregate basis weight of at least about 20 g/m^2, preferably at least about 40 g/m^2, and more preferably at least about 60 g/m^2. The total aggregate basis weight of the present cleaning sheets is typically no greater than about 275 g/m^2, preferably no greater than about 200 g/m^2, and more preferably no greater than about 150 g/m^2.

The cleaning sheets of the present invention can be made using either a woven or nonwoven process, or by forming operations using melted materials laid down on forms, especially in belts, and/or by forming operations involving mechanical actions/modifications carried out on films. The structures are made by any number of methods (e.g., spunbonded, meltblown, resin bonded, heat-bonded, air-through bonded, etc.), once the desired characteristics are known. However, the preferred structures are nonwoven, and especially those formed by hydroentanglement and/or heat-bonding as is well known in the art, since they provide highly desirable open structures. Therefore, preferred cleaning sheets are nonwoven structures having the characteristics described herein. Materials particularly suitable for forming the preferred nonwoven cleaning sheet of the present invention include, for example, natural cellulosics as well as synthetics such as polyolefins (e.g., polyethylene and polypropylene), polyesters, polyamides, synthetic cellulosics (e.g., RAYON®), and blends thereof. Also useful are natural fibers, such as cotton or blends thereof and those derived from various cellulosic sources, however these are not preferred. Preferred starting materials for making the cleaning sheets of the present invention are synthetic materials, which may be in the form of carded, spunbonded, meltblown, airlaid, or other structures. Cleaning sheets comprising synthetic materials or fibers typically have desirable electrostatic properties, which is preferred. Particularly preferred are polyesters, especially carded polyester fibers. The degree of hydrophobicity or hydrophilicity of the fibers is optimized depending upon the desired goal of the sheet, either in terms of type of soil to be removed, the type of additive that is provided, biodegradability, availability, and combinations of such considerations. In general, the more biodegradable materials are hydrophilic, but the more effective materials tend to be hydrophobic.

The cleaning sheets may be formed from a single fibrous layer, but preferably are a composite of at least two separate layers. As noted above, preferred cleaning sheets in the present invention include a variety of cleaning sheet structures, such as heat-bonded cleaning sheets and/or hydroentangled cleaning sheets.

The present cleaning sheets comprise an additive. The type and level of additive is selected such that the cleaning sheet has the ability to effectively pick-up and retain particulate material, while maintaining the electrostatic properties of the cleaning sheet and minimizing the residue left on a surface being wiped with the cleaning sheet.

Cleaning sheets useful in the present invention include, but are not limited to, those described in copending U.S. Application Serial No. 09/082,349, filed May 20, 1998 by Fereshtehkhou et al. (Case 6664M); copending U.S. Application Serial No. 09/082,396, filed May 20, 1998 by Fereshtehkhou et al. (Case 6798M); U.S. Patent No. 5,525,397 issued June 11, 1996 to Shizuno et al.; EP 774,229 A2 published May 21, 1997; EP 777,997 A2 published June 11, 1997; and JP 09-224,895 published September 2, 1997; JP 09-313,416 published December 9, 1997; which are all hereby incorporated by reference herein.

A. Preferred Heat-Bonded Cleaning Sheets

A preferred heat-bonded cleaning sheet of the present invention preferably has at least two distinct regions of differing basis weight. In a preferred embodiment, the present cleaning sheet has two distinct regions of differing basis weight and comprises a first basis weight region of relatively high basis weight and a second basis weight region of relatively low basis weight. The first region of relatively high basis weight exhibits a basis weight of typically at least about 80 g/m2, preferably at least about 130 g/m2, more preferably at least about 170 g/m2, and even more preferably at least about 200 g/m2, and typically no greater than about 300 g/m2, preferably no greater than about 275 g/m2, more preferably no greater than about 250 g/m2, and even more preferably no greater than about 240 g/m2. This first region of relatively high basis weight is preferably located in the middle of the cleaning sheet, in the Y dimension, as is shown in **FIG. 5**. The first region of relatively high basis weight typically accounts for at least 30%, preferably at least about 40%, more preferably at least about 45%, and even more preferably at least about 50%, of the area of the cleaning sheet. The first region of relatively high basis weight also typically accounts for no greater than about 90%, preferably no greater than about 80%, more preferably no greater than about 70%, and even more preferably no greater than about 60%, of the area of the cleaning sheet. The cleaning sheet will also preferably have a second region of relatively low basis weight, typically divided between the sides of the sheet as shown in **FIG. 5**, of typically no greater than about 70%, preferably no greater than about 60%, more preferably no greater than about 55%, and even more preferably no greater than about 50%, and typically at least about 10%, preferably at least about 20%, more preferably at least about 30%, and even more preferably at least

about 40%. In another aspect of the invention, there is only one macroscopic basis weight region comprising the higher basis weight material.

The present cleaning sheets preferably comprise brushy filaments as depicted in the cleaning sheet shown in **FIG. 5** and as depicted in the process shown in **FIG. 6**. The brushy filaments are attached to the cleaning sheet to aid in particulate pick-up and retention. The brushy filaments are preferably formed from a bundle of polyester continuous filaments

In regard to a cleaning sheet for use with a handle as described herein, a region of relatively high basis weight is preferably located on the sheet such that the region of relatively high basis weight contacts the surface being cleaned during a typically cleaning method by wiping the surface with the cleaning sheet. The region of relatively low basis weight is preferably located on the sheet such that the region of relatively low basis weight is engaged by a holding means/gripping means located in a head of a handle.

Process for Making Preferred Heat-Bonded Cleaning Sheets

A process for making heat-bonded cleaning sheets that are useful in the present invention is depicted in **FIG. 6**. During this process, a continuous first web 310 made of polypropylene having a width of 210mm and a basis weight of 30g/m2 is continuously fed from left to right as viewed in the diagram. Simultaneously, a tow 312 comprising a bundle of 2,000 - 100,000 polyester continuous filaments 315 each of 2 - 30 deniers is continuously fed from lef to right as viewed in the diagram. The tow 312 is opened or fibrillated by a set of expanding rolls 311 to form a continuous second web having a desired width and thereafter placed upon the first web 310. The first web 310 and the second web 312 are transported to a heating emboss machine 320 in which they are compressed together under heating and integrally heat-sealed along thereby formed heat-seal lines 316 transversely extending to form a continuous composite third web 321. The heat-seal lines 316 are provided so as to be spaced apart one from another by a distance d as measured longitudinally of the third web, i.e., intermittently arranged longitudinally of the third web 321. Thereafter, the second web 312 is cut by a first cutter 325 along a middle line extending parallel to and between each pair of adjacent heat-seal lines 316 in two. Then, the first web 310 is cut by a second cutter 326 into a desired length. In this manner, the individual cleaning sheets 1 are obtained from the third web 321. In this process, the individual basic sheets 10 are obtained from the first web 310, the brushy filaments 11 are obtained from the second web 312, the individual filaments 15 of the brushy filaments 11 are obtained from the continuous filaments 315 and the anchoring portions 16 are provided by the heat-seal lines 316. Preferably, each of the heat-seal lines 316

has a width of 2 - 10mm and is spaced apart from the adjacent heat-seal line by a distance d of 20 - 200mm. The brushy filaments 11 or the second web or the tow 312 prior to formation of these brushy filaments 11 are sprayed or rolled with an additive as described herein at an appropriate step of the process. In a section of the first web 310 to be cut by the second cutter 326, a distance D between each pair of adjacent heat-seal lines 316 may be dimensioned to be longer than the distance d to obtain a relatively large marginal region 7 facilitating the cleaning sheet 1 to be mounted on the holder 2. In this case, the ection defined between two adjacent heat-seal lines spaced from each other by the distance D necessarily provides relatively long brushy filaments 11 and these brushy filaments 11 must be cut to a length in conformity of the remainder brushy filaments 11. According to the process illustrated, a length of each filament 15 hanging down from the anchoring portion 16 corresponds to about 1/2 to about 9/10 of the distance d. If desired, a length of the second web 312 fed on the section of the first web 310 defined between each pair of adjacent heat-seal lines 316 may be dimensioned to be longer than the distance d in order to obtain the filaments 15 longer than 1/2 of the distance d.

In the process for making heat-bonded cleaning sheets according to the present invention, particular types of materials used as the basic sheet 10 and the brushy filaments 11 are not critical so far as they are mutually heat-sealable. However, it is generally preferable to use thermoplastic synthetic resin as the materials for these components. Additionally, the first web 310 and the second web 312 made of thermoplastic synthetic resin may be mixed with non-heat-sealable filaments such as rayon unless they exceed 20% by weight. Such non-heat-sealable filaments will be embedded in the material heat-sealed along the respective heat-seal lines 316 and fixed thereto. Furthermore, continuous plastic film may be employed for nonwoven fabric as the first web 310.

The process allows for the density of the brushy filaments planted on the basic sheet to be easily improved merely by increasing the number of filaments constituting the tow or web, since the tow or web comprising the heat-sealable filaments and the basic sheet of the heat-sealable nature are heat-sealed together followed by transversely cutting the tow or web to form the brushy filaments of said cleaning sheet.

B. Preferred Hydroentangled Cleaning Sheets

Hydroentangled cleaning sheets are particularly useful in the present invention due to their ability to effectively pick-up and retain particulate material from surfaces.

Hydroentangled cleaning sheets can be woven or nonwoven, however, the preferred hydroentangled sheets of the present invention are nonwoven.

The present invention encompasses a wide variety of structures of hydroentangled cleaning sheets. The cleaning sheets can have relatively uniform basis weight across the entire area of the sheet, or the cleaning sheets can have discrete regions of differing basis weight. In addition, the cleaning sheets can have relatively flat surfaces, or the cleaning sheets can exhibit macroscopic three-dimensionality.

To enhance the integrity of the present hydroentangled cleaning sheets, it is preferred to include a polymeric net (referred to herein as a "scrim" material) that is arranged with the fibrous material, e.g., though lamination via heat or chemical means such as adhesives, via hydrogentanglement. Scrim materials useful herein are described in detail in U.S. Patent No. 4,636,419, which is incorporated by reference herein. The scrims may be formed directly at the extrusion die or can be derived from extruded films by fibrillation or by embossment, followed by stretching and splitting. The scrim may be derived from a polyolefin such as polyethylene or polypropylene, copolymers thereof, poly(butylene terephthalate), polyethylene terephthalate, Nylon 6, Nylon 66, and the like. Scrim materials are available from various commercial sources. A preferred scrim material useful in the present invention is a polypropylene scrim, available from Conwed Plastics (Minneapolis, MN).

Hydroentangled cleaning sheets suitable for the present invention include those described in copending U.S. Application Serial No. 09/082,349, filed May 20, 1998 by Fereshtehkhou et al. (Case 6664M); copending U.S. Application Serial No. 09/082,396, filed May 20, 1998 by Fereshtehkhou et al. (Case 6798M); and U.S. Patent No. 5,525,397 issued June 11, 1996 to Shizuno et al.

i. Optional Multiple Basis Weights

Hydroentangled cleaning sheets useful in the present invention can have at least two regions, where the regions are distinguished by basis weight. In particular, the cleaning sheet can comprise one or more high basis weight regions having a basis weight of from about 30 to about 120 g/m^2 (preferably from about 40 to about 100 g/m^2, more preferably from about 50 to about 90 g/m^2, still more preferably from about 60 to about 80 g/m^2) and one or more low basis weight regions, wherein the low basis weight region(s) have a basis weight that is not more than about 80% of the basis weight of the high basis weight region(s). Preferred cleaning sheets in this regard comprise a continuous high basis weight region and a plurality

of discontinuous regions circumscribed by the continuous high basis weight region, wherein the discontinuous regions are disposed in a nonrandom, repeating pattern and have a basis weight of not more than about 80% of the basis weight of the continuous region.

Preferably, the low basis weight region(s) of the cleaning sheet will have a basis weight of not more than about 60%, more preferably not more than about 40%, and still more preferably not more than about 20%, of the basis weight of the high basis weight region(s). The cleaning sheets will preferably have an aggregate basis weight of from about 20 to about 110 g/m^2, more preferably from about 40 to about 100 g/m^2, still more preferably from about 60 to about 90 g/m^2. With respect to the low basis weight region(s), it is preferred that the basis weight not be zero in such regions such that macroscopic apertures are present. This is because soil will be allowed to penetrate completely through the cleaning sheet, and will not be retained therein. In other words, the entrapment level of the sheet will not be optimized in such situations.

In those embodiments where a continuous high basis weight region surrounds discrete low basis weight regions, it is preferred that at least about 5% of the cleaning sheet's total surface area be the low basis weight regions. More preferably, at least about 10%, still more preferably at least about 15%, still more preferably at least about 20%, still more preferably at least about 30%, of the cleaning sheet's total surface area will be the low basis weight regions. In those embodiments where discrete high basis weight regions are surrounded by a continuous low basis weight region, it is preferred that at least about 5% of the cleaning sheet's total surface area be the discrete high basis weight regions. More preferably, at least about 10%, still more preferably at least about 15%, still more preferably at least about 20%, still more preferably at least about 30%, of the cleaning sheet's total surface area will be the high basis weight regions.

In those preferred embodiments having a continuous high basis weight region surrounding discrete, low basis weight regions, the discrete low basis weight regions may be staggered in, or may be aligned in, either or both of the X and Y directions. Preferably, the high basis weight essentially continuous network forms a patterned network circumjacent the discrete low basis weight regions, although, as noted, small transition regions may be accommodated.

It will be apparent to one skilled in the art that there may be small transition regions having a basis weight intermediate the basis weights of the high basis weight region(s) and the low basis weight region(s), which transition regions by themselves may not be significant

enough in area to be considered as comprising a basis weight distinct from the basis weights of either adjacent region. Such transition regions are within the normal manufacturing variations known and inherent in producing a structure according to the present invention. It will also be recognized that within a given region (whether high or low basis weight), ordinary and expected basis weight fluctuations and variations may occur, when such given region is considered to have one basis weight. For example, if on a microscopic level, the basis weight of an interstice between fibers is measured, an apparent basis weight of zero will result when, in fact, the basis weight of such region is greater than zero. Again, such fluctuations and variations are a normal and expected result of the manufacturing process.

FIG. 7 is a photograph of a portion of a preferred nonwoven sheet of the present invention having a continuous high basis weight region surrounding discrete low basis weight regions. While no call-out numbers are shown, it is seen that the high basis weight continuous region appears as the light network and the low basis weight regions are the darker discrete regions. **FIG. 8** is plan view of a portion of a nonwoven sheet 10 to further depict this aspect of the sheet shown in **FIG. 7**. In particular, in **FIG. 8**, nonwoven sheet 10 has a continuous high basis weight region 12 and discrete low basis weight regions 14. In this representative illustration, an optional scrim material is not shown. While the low basis weight regions 14 are depicted as being of essentially the same size and of a single well defined shape, these regions may be of differing sizes to facilitate entrapment of particles of varying size and shape. Also, it will be recognized that the shape of the low basis weight regions 14, and accordingly the continuous high basis weight region 12, may vary throughout the structure.

Differences in basis weights (within the same structure 10) between the high and low basis weight regions 12 and 14 of at least 20% are considered to be significant, and define distinct regions for purposes of the present disclosure. For a quantitative determination of basis weight in each of the regions 12 and 14, and hence a quantitative determination of the differences in basis weight between such regions 12 and 14, a quantitative method, such as image analysis of soft X-rays as disclosed in U.S. Patent No. 5,277,761, issued to Phan et al. on January 11, 1994, may be utilized, which patent is incorporated herein by reference. This method is also applicable where the regions of high and low basis weight are not arranged in a continuous/discrete pattern.

The relative area of the low basis weight regions and high basis weight region can be measured quantitatively using image analysis techniques as described in copending U.S.

Application Serial No. 09/082,349, filed May 20, 1998 by Fereshtehkhou et al. (Case 6664M), which is hereby incorporated by reference.

ii. Optional Macroscopic Three-Dimensionality

In one embodiment the cleaning sheets will also be macroscopically three-dimensional. These sheets are preferably relatively open structures compared to, e.g., paper towels. In one such preferred embodiment, the macroscopically three-dimensional cleaning sheets have a first surface and a second surface and comprise a scrim or other contractible material. In one such preferred embodiment, the cleaning sheet has a first outward surface and a second outward surface and comprises a contractible (preferably a scrim) material, wherein the Average Peak to Peak Distance of at least one outward surface is preferably at least about 1 mm and the Surface Topography Index of that surface(s) is preferably from about 0.01 to about 5. Methods for measuring Average Peak to Peak Distance and Average Height Differential are described in detail in copending U.S. Application Serial No. 09/082,349, filed May 20, 1998 by Fereshtehkhou et al. (Case 6664M), which is hereby incorporated by reference.

Regardless of the configuration of the cleaning sheets, the Average Peak to Peak Distance of at least one outward surface will preferably be at least about 1 mm, more preferably at least about 2 mm, and still more preferably at least about 3 mm. In one embodiment, the Average Peak to Peak distance is from about 1 to about 20 mm, particularly from about 3 to about 16 mm, more particularly from about 4 to about 12 mm. The Surface Topography Index of at least one outward surface will preferably be from about 0.01 to about 10, preferably from about 0.1 to about 5, more preferably from about 0.2 to about 3, still more preferably from about 0.3 to about 2. At least one outward surface will preferably have an Average Height Differential of at least about 0.5 mm, more preferably at least about 1 mm, and still more preferably at least about 1.5 mm. The Average Height Differential of at least one outward surface will typically be from about 0.5 to about 6 mm, more typically from about 1 to about 3 mm.

C. Other Cleaning Sheets

Other cleaning sheets which are useful in the present invention include those which are spun-bonded, meltblown, airlaid, and the like.

D. Additive

The cleaning performance of any of the cleaning sheets of the present invention can be further enhanced by treating the fibers of the sheet, especially surface treating, with any of

a variety of additives, including surfactants or lubricants, that enhance adherence of soils to the sheet. When utilized, such additives are added to the cleaning sheet at a level sufficient to enhance the ability of the sheet to adhere soils. However, the level and type of additive must be selected to minimize the amount of residue left on the surface being cleaned by the cleaning sheet. Such additives are preferably applied to the cleaning sheet at an add-on level of at least about 0.01%, more preferably at least about 0.1%, more preferably at least about 0.5%, more preferably at least about 1%, still more preferably at least about 3%, still more preferably at least about 4%, by weight. Typically, the add-on level is from about 0.1 to about 25%, more preferably from about 0.5 to about 20%, more preferably from about 1 to about 15%, still more preferably from about 2 to about 10%, still more preferably from about 4 to about 8%, and most preferably from about 4 to about 6%, by weight of the dry cleaning sheet. The level and type of additive must be carefully selected to minimize the residue that is left of the surface wiped with the present cleaning sheets to leave the surface visually acceptable to consumers.

A preferred additive is a wax or a mixture of an oil (e.g., mineral oil, etc.) and a wax. Suitable waxes include various types of hydrocarbons, as well as esters of certain fatty acids (e.g., saturated triglycerides) and fatty alcohols. They can be derived from natural sources (i.e., animal, vegetable or mineral) or can be synthesized. Mixtures of these various waxes can also be used. Some representative animal and vegetable waxes that can be used in the present invention include beeswax, carnauba, spermaceti, lanolin, shellac wax, candelilla, and the like. Representative waxes from mineral sources that can be used in the present invention include petroleum-based waxes such as paraffin, petrolatum and microcrystalline wax, and fossil or earth waxes such as white ceresine wax, yellow ceresine wax, white ozokerite wax, and the like. Representative synthetic waxes that can be used in the present invention include ethylenic polymers such as polyethylene wax, chlorinated naphthalenes such as "Halowax," hydrocarbon type waxes made by Fischer-Tropsch synthesis, and the like. Other preferred additives are supplied as mixtures of wax and oil, such as petrolatum. Such additives can be used by themselves or in combination with other wax and oils.

A preferred additive is a mixture of a wax and mineral oil, as it enhances the ability of the cleaning sheet to pick up and retain particulate material from surfaces, while minimizing the amount of residue left on the surface being wiped with the cleaning sheet. When a mixture of mineral oil and wax is utilized, the components will preferably be mixed in a ratio of oil to wax of from about 1:99 to about 7:3, more preferably from about 1:99 to

about 3:2, still more preferably from about 1:99 to about 2:3, by weight. In a particularly preferred embodiment, the ratio of oil to wax is about 1:1, by weight, and the additive is applied at an add-on level of about 5%, by weight. A preferred mixture is a 1:1 mixture of mineral oil and paraffin wax.

Wax alone, such as paraffin wax, can be utilized as an additive to the present cleaning sheets. Where a wax is the only additive, the cleaning sheets are preferably comprised of synthetic fibers, so that the cleaning sheet is still able to maintain electrostatic properties to provide enhanced particulate material pick-up and retention. In any event, if the cleaning sheet comprises natural and/or synthetic fibers, an additive that consists essentially of wax is typically applied to the present cleaning sheets at an add-on level of no greater than about 4%, preferably no greater than about 3%, more preferably no greater than about 2%, and even more preferably no greater than about 1%, by weight of the cleaning sheet. These levels are preferred because if a wax additive is applied to the cleaning sheets at higher levels, the electrostatic properties of the sheet will typically be diminished, and therefore decrease the overall cleaning performance of the sheet.

Mineral oil alone can also be utilized as an additive to the present cleaning sheets. However, if only mineral oil is used, it must be at a relatively low add-on level in order to minimize the residue left on surfaces wiped with the cleaning sheet to leave the surface visually acceptable to consumers. An additive consisting essentially of mineral oil is typically applied to the present cleaning sheets at an add-on level of no greater than about 4%, preferably no greater than about 3%, more preferably no greater than about 2%, and even more preferably no greater than about 1%, by weight of the cleaning sheet.

These low levels are especially desirable when additives are applied at an effective level and preferably in a substantially uniform way to at least one discrete continuous area of the sheet. Use of the preferred lower levels, especially of additives that improve adherence of soil to the sheet, provides surprisingly good cleaning, dust suppression in the air, preferred consumer impressions, especially tactile impressions, and, in addition, the additive can provide a means for incorporating and attaching perfumes, pest control ingredients, antimicrobials, including fungicides, and a host of other beneficial ingredients, especially those that are soluble, or dispersible, in the additive. These benefits are by way of example only. Low levels of additives are especially desirable where the additive can leave a visual residue on the surfaces that are treated. As a result, the level and type of additive selected are typically important to enhance the particulate pick up and retention properties of the cleaning

sheet, while minimizing the amount of residue left on the surface being wiped with the cleaning sheet.

The application means for these additives preferably applies at least a substantial amount of the additive at points on the sheet that are "inside" the sheet structure. It is an especial advantage of the three dimensional structures and/or multiple basis weights, that the amount of additive that is in contact with the skin and/or surface to be treated, and/or the package, is limited, so that materials that would otherwise cause damage, or interfere with the function of the other surface, can only cause limited, or no, adverse effects. The presence of the additive inside the structure is very beneficial in that soil that adheres inside the structure is much less likely to be removed by subsequent wiping action.

Preferably, the additive does not significantly diminish the electrostatic properties of the cleaning sheet. It is preferable that the cleaning sheet of the present invention have electrostatic properties in order to facilitate pick-up and retention of particulate material, especially for fine dust particulate material.

The additive can be applied to the present cleaning sheets via a variety of application methods. Such methods include manual rolling, mechanical rolling, slotting, ultrasonic spraying, pressurized spraying, pump spraying, dipping, and the like. A preferred method of application of the additive to the cleaning sheet is by ultrasonic spraying. The additive is preferably uniformly sprayed onto the cleaning sheet.

Another preferred method of application of the additive to the cleaning sheet is by mechanical rolling. During the process of making the cleaning sheets, the sheets are fed through a set of rollers that are coated with the additive to be applied. The rollers can be coated with the additive by rotating in a pan or reservoir containing the additive. As the sheets are fed through the rollers, the additive is transferred from the rollers to the cleaning sheets. If the additive is a mixture of a wax and mineral oil, particularly in a ratio of wax to mineral oil of 1:1, the pan or reservoir containing the additive is preferably heated to a temperature of from about 32°C to about 98°C, preferably from about 40°C to about 65°C, in order to maintain the additive in a fluid state. In such a situation, the rollers are also preferably heated to a temperature similar to the temperature of the hot additive in a fluid state. Typically the temperature of the additive mix and the rollers are maintained at least about 5°C to about 10°C greater than the melting point of the additive mixture.

For small scale production of the present cleaning sheets, the additive can also be applied to the cleaning sheet via manual rolling, which comprises taking a hand-held roller, coating the roller with additive, and rolling the roller across the surface of the cleaning sheet.

III. Cleaning Implement

In another respect, the present invention relates to a cleaning implement comprising the cleaning sheets discussed above. In one aspect, the cleaning implement comprises:

a. a handle; and

b. a removable cleaning sheet comprising an additive as described hereinbefore.

As discussed above, in this aspect of the invention, a cleaning sheet of the cleaning implement can have a continuous region surrounding discrete regions that differ with regard to basis weight. Preferred is where the continuous region has a relatively higher basis weight than the discrete regions. The sheet aspect of the implement may also exhibit macroscopic three-dimensionality.

The implement and, separately, the cleaning sheet of the present invention are designed to be compatible with all hard surface substrates, including wood, vinyl, linoleum, no wax floors, ceramic, FORMICA®, porcelain, and the like.

The handle of the cleaning implement comprises any elongated, durable material that will provide ergonomically practical cleaning. The length of the handle will be dictated by the end-use of the implement.

The handle will preferably comprise at one end a support head to which the cleaning sheet can be releasably attached. To facilitate ease of use, the support head can be pivotably attached to the handle using known joint assemblies. Any suitable means for attaching the cleaning sheet to the support head may be utilized, so long as the cleaning sheet remains affixed during the cleaning process. Examples of suitable fastening means include clamps, hooks & loops (e.g., VELCRO®), and the like. In a preferred embodiment, the support head will comprise means for gripping the sheet on it's upper surface to keep the sheet mechanically attached to the head during the rigors of cleaning. However, the gripping means will readily release the sheet for convenient removal and disposable.

The cleaning sheets useful in the cleaning implement of the present invention are as described above.

IV. Methods of Use and Articles of Manufacture

The present invention further encompasses methods of cleaning surfaces using the cleaning sheets, with or without an additive, described herein. A method of cleaning a surface generally comprises contacting said surface with a cleaning sheet as described herein. The surfaces are usually contacted by wiping the cleaning sheet across the surface. The wiping can be carried out using a back-and-forth wiping motion across the surface being cleaned or in an S-pattern as shown in Section V.B, *infra*. The cleaning sheet can be wiped across the surface using one's hand, preferably for hand dusting, or using a handle such as the cleaning implements described herein, preferably for floor cleaning or cleaning hard-to-reach surfaces, such as ceilings and walls. Such methods effectively remove dust/particulate matter from the surfaces.

Large particulate matter, such as crumbs, sand, pebbles, grass, and the like, tends to be more difficult to pick-up and remove from surfaces, including floors such as vinyl, linoleum, hardwood, ceramic, and the like. While the cleaning sheets herein are effective in removing large particulate matter from surfaces, their effectiveness can be improved by using a "stamping" step in the cleaning method. As the cleaning sheet is wiped across the surface being cleaned, particulate matter that is not collected by the cleaning sheet can be arranged in a pile. Then, the cleaning sheet can be lifted from the surface and pressed down onto the pile of particulate matter (i.e. the "stamping" step). Pressure is applied to the cleaning sheet as it is pressed down on the pile to at least partially embed the particulate matter into the cleaning sheet. Preferably, the pressure applied to the cleaning sheet can result from either: the weight of the cleaning sheet and/or implement itself; application of hand pressure to the cleaning sheet and/or implement; stepping on the cleaning sheet and/or implement with one's foot; and the like. The amount of pressure applied preferably ranges from about 1.5 g/cm^2 to about 200 g/cm^2, more preferably from about 5 g/cm^2 to about 170 g/cm^2, even more preferably from about 7 g/cm^2 to about 75 g/cm^2, and still more preferably from about 10 g/cm^2 to about 20 g/cm^2. After the "stamping" step, the cleaning sheet is then lifted from the pile of particulate matter. This "stamping" step effectively improves removal of large particulate matter from surfaces using the methods herein. The "stamping" step can be even more effective when the cleaning sheet contains an additive as described herein.

It can be important to instruct a consumer of the cleaning sheet to utilize a "stamping" step in the cleaning methods as described above in order for the consumer to experience improved cleaning performance of the cleaning sheet. As such, the present invention further relates to articles of manufacture that comprise a cleaning sheet packaged in a container and

informational indicia in association with said container and/or cleaning sheets to communicate the benefits and methods of use to the consumer. As used herein, the phrase "in association with" means the instructions are either directly printed on the container itself or presented in a different manner including, but not limited to, a brochure, print advertisement, electronic advertisement, and/or verbal communication, so as to communicate the set of instructions to a consumer of the article of manufacture.

Suitable containers for the present articles of manufacture include plastic flow-wrap pouches, non-resealable flexible pouches having slit-like openings, paperboard cartons, cardboard cartons, and the like. Preferably, the container is a paperboard or cardboard carton as described in co-pending U.S. Application Serial No. 09/374,715 filed August 13, 1999 by Hardy (P&G Case 7717), which is incorporated herein by reference.

The informational indicia in association with the container and/or cleaning sheets can be a set of worded instructions, a series of pictograms (i.e. icons or logos), and the like, that communicate the benefits of the methods herein and the steps to carry out the methods herein. Preferably, the informational indicia is a set of instructions comprising an instruction to contact a surface containing particulate matter with a cleaning sheet, with or without an additive, as described herein; wipe said surface with said cleaning sheet to arrange said particulate matter into a pile; press (or "stamp") said cleaning sheet down onto said pile of particulate matter (preferably using hand pressure); and lift said cleaning sheet from said pile of particulate matter. The preferred set of instructions further comprises an instruction to dispose of said cleaning sheet after lifting said cleaning sheet from said pile of particulate matter. By instructing the consumer to perform the "stamping" step, the consumer is able to achieve improved cleaning performance which he or she otherwise would not achieve. The improved cleaning performance typically achieved by utilizing the "stamping" step is at least two times the performance of the cleaning sheet without utilizing the "stamping step" with regard to the percentage of particulate matter pick-up. This improved cleaning performance can be as high as four to six times the performance achieved without the "stamping" step with regard to percentage of particulate matter pick-up.

V. <u>Test Methods</u>

A. <u>Residue Test for Filming and Streaking</u>

The degree of residue remaining on a surface which is wiped with a cleaning sheet is measured in terms of filming and/or streaking according to the following test method. This test method is performed by carrying out the following steps:

1. Pre-clean both sides of a clear glass surface with a commercial glass cleaner, such as Cinch®, followed by isopropanol until there are no visible smudges or streaks. Divide the glass surface into quarters to create 4 equal test areas, approximately 28 cm wide by 18 cm long.
2. Fold the first cleaning sheet to be tested into eighths. Using consistent pressure and speed, wipe the test area with the folded sheet in a pattern of 4 horizontal strokes and 7 vertical strokes, covering the entire test area. Flip the folded sheet over, placing an unused section of sheet onto the glass, and repeat the 4 horizontal and 7 vertical strokes on the same test surface area, while keeping the wiping speed and pressure consistent.
3. Flip the glass surface onto its back side. Unfold the sheet once (leaving it folded in half) and refold it, exposing two unused quarters of the sheet. Repeat step 2 on the back surface of the same test area.
4. Repeat steps 2 and 3 for up to 3 additional sheets on the other glass test areas.
5. Each test area is visually graded on a 0-4 scale using increments of .125 by looking through the glass surface at a single blue light in a darkened room. The amount of filming and/or streaking on the glass surface is visually graded according to the following scale:

   0 = no films/streaks

   1 = light films/streaks

   2 = medium films/streaks

   3= heavy films/streaks

   4 = very heavy films/streaks

The results are the average of 3 replications of the test method and are shown below in Table 1 under the column heading "RESIDUE GRADE".

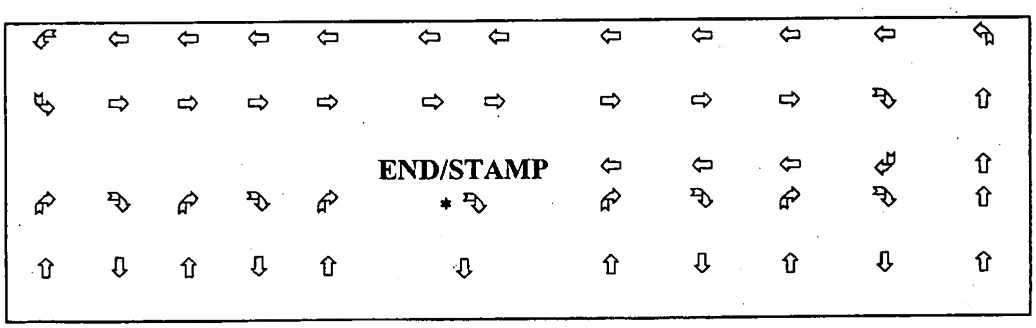
B. Particulate Pick-up Performance Test

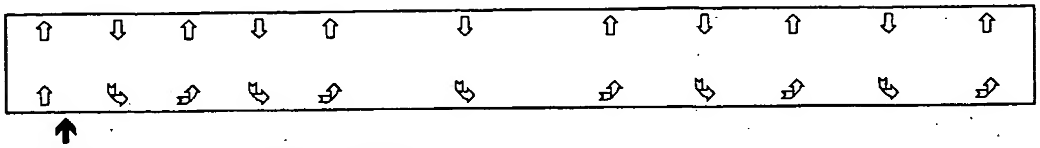
The ability of a cleaning sheet to pick-up particulate material from a surface is measured according to the following test method. This test method is performed by carrying out the following steps:

1. A soil is prepared to simulate the particulate material that is typically found on household surfaces. The soil used in this test method consists of the following: 0.50 g of vacuum cleaner soil (i.e. dirt collected from vacuum cleaner bags), 0.50

g of fluffy soil (composed of a 50/50 mix of finely shredded cellulose and vacuum cleaner soil), and 0.02 g of pet hair.

2. A vinyl flooring test surface area, which is approximately 1.5 meters x 21 meters, is then prepared for testing by pre-cleaning the vinyl flooring with a 20% isopropanol solution and buffing the surface of the vinyl flooring dry. After the surface is dry, clean the surface with a commerical Swiffer® implement and clean Swiffer® sheet to standardize the electrostatic charge on the surface.
3. The soil (described above) is weighed and then dispersed evenly across the surface of the pre-cleaned vinyl flooring within the test surface area of approximately 1.5 meters x 21 meters.
4. A cleaning sheet to be tested is weighed and then placed on an implement with mop handle and pad, such as a Swiffer® implement. The surface of the vinyl flooring is then cleaned in the following pattern: Floor is swept using an up and down S - pattern. The first two thirds of the width of the floor is cleaned starting on the left front side and ending on the right two/thirds side. Halfway through the cycle, the mophead should be swiveled to change the leading edge from the front to the back. After switching the leading/trailing edge, soil may fall off the sheet. If this is the case the mop is run over the soil that has fallen off. Then, continue the up and down S - pattern. Once the end of the surface has been reached, push the mop straight forward until you come to the right back corner of the testing surface. Turn mop head to the left and continue pushing across the back of the baseboard, cleaning the back one-thirds. One you reach the corner, turn mop head to the left, and push it across the length of the flooring. Once you come to the end of the surface, turn mop head to the right and bring soil pile to the middle of the flooring. This cleaning pattern is depicted as follows:





START * FLIP STEP

6. After Step 1 and 2 have been completed, pick mop head off the floor and carefully place it directly on top of the soil pile. With moderate pressure, push down on the soil pile and lift.

7. Re-weigh the cleaning sheet on an analytical balance and record sheet weight.

8. Data is calculated and reported using the following formula:

% Sheet Pickup = (Final Sheet Weight - Initial Sheet Weight) / 1.05g X 100

The results of this test method (being an average of 3 replications) are shown below in Table 1 under the column heading "PARTICULATE PICK-UP".

The following are non-limiting examples of the cleaning sheets of the present invention.

EXAMPLES

The following exemplify cleaning sheets of the present invention. Table 1 provides the results of the Residue Test for Filming and Streaking and the Particulate Pick-up Performance Test for the exemplified cleaning sheets.

EXAMPLE SHEET A

This example describes a process of making a cleaning sheet as illustrated by the diagram of **FIG. 2**. During this process, a continuous first web 310 made of polypropylene having a width of 210mm and a basis weight of 30g/m2 is continuously fed from left to right as viewed in the diagram. Simultaneously, a tow 312 comprising a bundle of 2,000 - 100,000 polyester continuous filaments 315 each of 2 - 30 deniers is continuously fed from left to right as viewed in the diagram. The tow 312 is opened or fibrillated by a set of expanding rolls 311 to form a continuous second web having a desired width and thereafter placed upon the first web 310. The first web 310 and the second web 312 are transported to a heating emboss machine 320 in which they are compressed together under heating and integrally heat-sealed along thereby formed heat seal lines 316 transversely extending to form a continuous composite third web 321. The heat-seal lines 316 are provided so as to be spaced apart one

from another by a distance d as measured longitudinally of the third web, i.e., intermittently arranged longitudinally of the third web 321. Thereafter, the second web 312 is cut by a first cutter 325 along a middle line extending parallel to and between each pair of adjacent heat-seal lines 316 in two. Then, the first web 310 is cut by a second cutter 326 into a desired length. In this manner, the individual cleaning sheets 1 are obtained from the third web 321. In this process, the individual basic sheets 10 are obtained from the first web 310, the brushy filaments 11 are obtained from the second web 312, the individual filaments 15 of the brushy filaments 11 are obtained from the continuous filaments 315 and the anchoring portions 16 are provided by the heat-seal lines 316. Preferably, each of the heat-seal lines 316 has a width of 2 - 10mm and is spaced apart from the adjacent heat-seal line by a distance d of 20 - 200mm. The brushy filaments 11 or the second web or the tow 312 prior to formation of these brushy filaments 11 are coated with an additive as described in Table 1 at an appropriate step of the process. In a section of the first web 310 to be cut by the second cutter 326, a distance D between each pair of adjacent heat-seal lines 316 may be dimensioned to be longer than the distance d to obtain a relatively large marginal region 7 facilitating the cleaning sheet 1 to be mounted on the holder 2. In this case, the section defined between two adjacent heat-seal lines spaced from each other by the distance D necessarily provides relatively long brushy filaments 11 and these brushy filaments 11 must be cut to a length in conformity of the remainder brushy filaments 11. According to the process illustrated, a length of each filament 15 hanging down from the anchoring portion 16 corresponds to 1/2 of the distance d. If desired, a length of the second web 312 fed on the section of the first web 310 defined between each pair of adjacent heat-seal lines 316 may be dimensioned to be longer than the distance d in order to obtain the filaments 15 longer than 1/2 of the distance d.

A cleaning sheet resulting from this process is shown in **FIG. 5**.

EXAMPLE SHEET B

This example illustrates the combination of carded webs and a scrim (i.e., a net of polypropylene filament) to make a hydroentangled cleaning sheet of the present invention. Two carded polyester fiber webs with a scrim in between is prepared. The combination of the two carded webs and the scrim are then placed on top of an apertured forming belt (23C square weave available from Albany International, Engineered Fabrics Division, Appleton, WI) and are hydroentangled and dried. The water entangling process causes the fibers to become intertangled and to also become intertangled with the scrim, while causing the fibers to move apart and provide two distinct basis weight regions. During the drying process, the

hydroentangled sheet becomes "quilted" (i.e., greater three dimensionality is achieved) as a result of shrinkage of the polypropylene scrim relative to the polyester nonwoven. The nonwoven cleaning sheet is then coated with an additive described in Table 1.

As a preferred optional step, the entangled nonwoven sheet may be subjected to further heating, for example in a press at 180°C for 10 sec. (This heating may be performed before or after adding the surface treatment, but is preferably conducted prior to application of the additive.) This provides even further enhanced three-dimensionality.

A cleaning sheet resulting from this process is depicted in **FIGS. 7 and 8.**

TABLE 1

SHEET	BASIS WT[1]	ADDITIVE	LEVEL	APPLI-CATION METHOD	RESIDUE GRADE	PARTICU-LATE PICK-UP
A	135 g/m2	50% Paraffin Wax/ 50% Mineral Oil	0.4 g (4.62%)	Ultrasonic Spray	0.9	75%
A	135 g/m2	None	---	---	0.0	67%
A	135 g/m2	100% Mineral Oil	0.4 g (4.62%)	Ultrasonic Spray	3.4	78%
B	63 g/m2	50% Paraffin Wax/ 50% Mineral Oil	0.4 g (9.3%)	Machine Roll	0.6	81%
B	63 g/m2	None	---	---	0.01	81%
A	135 g/m2	50% Paraffin Wax/ 50% Mineral Oil	0.4 g (4.62%)	Manual Roll	1.9	84%
A	135 g/m2	50% Paraffin Wax/ 50% Mineral Oil	0.8 g (9.24%)	Ultrasonic Spray	2.6	79%
B	63 g/m2	100% Mineral Oil	0.4 g (4.62%)	Manual Roll	3.4	81%

[1] Total aggregate basis weight of the cleaning sheet.

The results above show that selection of the type and level of additive applied to the cleaning sheet is important to improve particulate pick-up of the cleaning sheet, while minimizing the amount of visual residue remaining on the surface wiped with the cleaning sheet.

What is claimed is:

1. A cleaning sheet characterized by comprising an additive comprising a wax, preferably selected from the group consisting of paraffin wax, microcrystalline wax, petrolatum, and mixtures thereof, and an oil, preferably mineral oil; wherein said cleaning sheet has a total aggregate basis weight of at least 120 g/m^2.

2. The cleaning sheet of Claim 1, wherein said additive is applied to said cleaning sheet at a level of from 0.01% to 25%, by weight of said cleaning sheet.

3. The cleaning sheet of Claim 2, wherein said additive comprises a ratio of said oil to said wax of from 1:99 to 7:3.

4. A cleaning sheet characterized by comprising no greater than 4%, preferably no greater than 3%, by weight of said cleaning sheet, of an additive comprising an oil; wherein said cleaning sheet has a total aggregate basis weight of from 20 g/m^2 to 275 g/m^2, preferably from 30 g/m^2 to 150 g/m^2.

5. The cleaning sheet of Claim 4, wherein said cleaning sheet comprises at least two distinct regions of differing basis weight, wherein a first basis weight region has a basis weight of from 80 g/m^2 to 300 g/m^2 and a second basis weight region has a basis weight of from 30 g/m^2 to 130 g/m^2.

6. The cleaning sheet of Claim 5, wherein said first basis weight region comprises a plurality of brushy filaments attached to at least one side of said cleaning sheet.

7. The cleaning sheet of Claim 4, wherein said cleaning sheet comprises a high basis weight continuous region having a basis weight of from 30 g/m^2 to 120 g/m^2 and a plurality of discrete low basis weight discontinuous regions circumscribed by said high basis weight continuous region, wherein said low basis weight discontinuous regions are disposed in a nonrandom, repeating pattern and have a basis weight of not more than 80% of said basis weight of said high basis weight continuous region.

8. A cleaning sheet characterized by comprising:

(a) at least two distinct regions of differing basis weight, wherein a first basis weight region has a basis weight of from 80 g/m^2 to 300 g/m^2 and a second basis weight region has a basis weight of from 30 g/m^2 to 130 g/m^2; and

(b) an additive comprising a wax, preferably selected from the group consisting of paraffin wax, microcrystalline wax, petrolatum, and mixtures thereof, and an oil, preferably mineral oil, at a level of from 0.01% to 25%, preferably no greater than 5%, by weight of said cleaning sheet;

wherein said cleaning sheet has a total aggregate basis weight of from 60 g/m^2 to 275 g/m^2.

9. The cleaning sheet of Claim 8, wherein said cleaning sheet further comprises a plurality of brushy filaments attached to at least one side of said cleaning sheet.

10. The cleaning sheet of Claim 9, wherein said additive comprises a ratio of said oil to said wax of from 1:99 to 7:3, preferably 1:1.

11. A cleaning sheet characterized by comprising no greater than 15%, by weight of said cleaning sheet, of an additive comprising a wax, preferably selected from the group consisting of paraffin wax, microcrystalline wax, petrolatum, and mixtures thereof; wherein said cleaning sheet has a total aggregate basis weight of from 20 g/m^2 to 275 g/m^2.

12. The cleaning sheet of Claim 11, wherein said cleaning sheet comprises synthetic fibers.

13. A cleaning sheet characterized by comprising:

(a) a base sheet;

(b) a plurality of brushy filaments attached to said base sheet; and

(c) an additive comprising a wax, preferably paraffin wax, and an oil, preferably mineral oil; wherein said additive is applied to said cleaning sheet at a level of no greater than 15%, by weight of said cleaning sheet;

wherein said cleaning sheet has a total aggregate basis weight of from 60 g/m^2 to 275 g/m^2.

14. The cleaning sheet of Claim 13, wherein said additive comprises a ratio of said oil to said wax of from 1:99 to 7:3 preferably 1:1.

15. A process for making a cleaning sheet comprising a base sheet, a plurality of brushy filaments attached to at least one side of said base sheet, and an additive, said process characterized by comprising the steps of:

(a) continuously feeding a first web for said base sheet comprising heat-sealable material;
(b) continuously feeding a second web comprising heat-sealable continuous filaments in a longitudinal direction thereof onto said first web;
(c) providing said first web and said second web with heat-seal lines extending transversely of said first and second webs and intermittently arranged longitudinally of said first and second webs so as to obtain a continuous composite third web integrally comprising said first and second webs;
(d) cutting said second web transversely thereof along a middle line extending parallel to and between each pair of adjacent heat-seal lines so that a length of said second web corresponding to a half of the length between each pair of adjacent cutting lines defines said brushy filaments;
(e) spraying or rolling an additive, preferably comprising a wax and an oil, onto said first and/or second webs, preferably at a level of no greater than 15%, by weight of said first and second webs; and
(f) cutting said first web into a desired length to obtain said cleaning sheet.

16. The process of Claim 15, wherein said additive is sprayed onto said first and second webs via ultrasonic spraying.

17. A cleaning sheet produced according to the process of Claim 15.

18. A process for making a cleaning sheet comprising a base sheet, a plurality of brushy filaments attached to at least one side of said base sheet, and an additive, said process comprising the steps of:

(a) continuously feeding a first web for said base sheet comprising heat-sealable material;
(b) continuously feeding a second web comprising heat-sealable continuous filaments in a longitudinal direction thereof onto said first web;

(c) providing said first web and said second web with heat-seal lines extending transversely of said first and second webs and intermittently arranged longitudinally of said first and second webs so as to obtain a continuous composite third web integrally comprising said first and second webs;

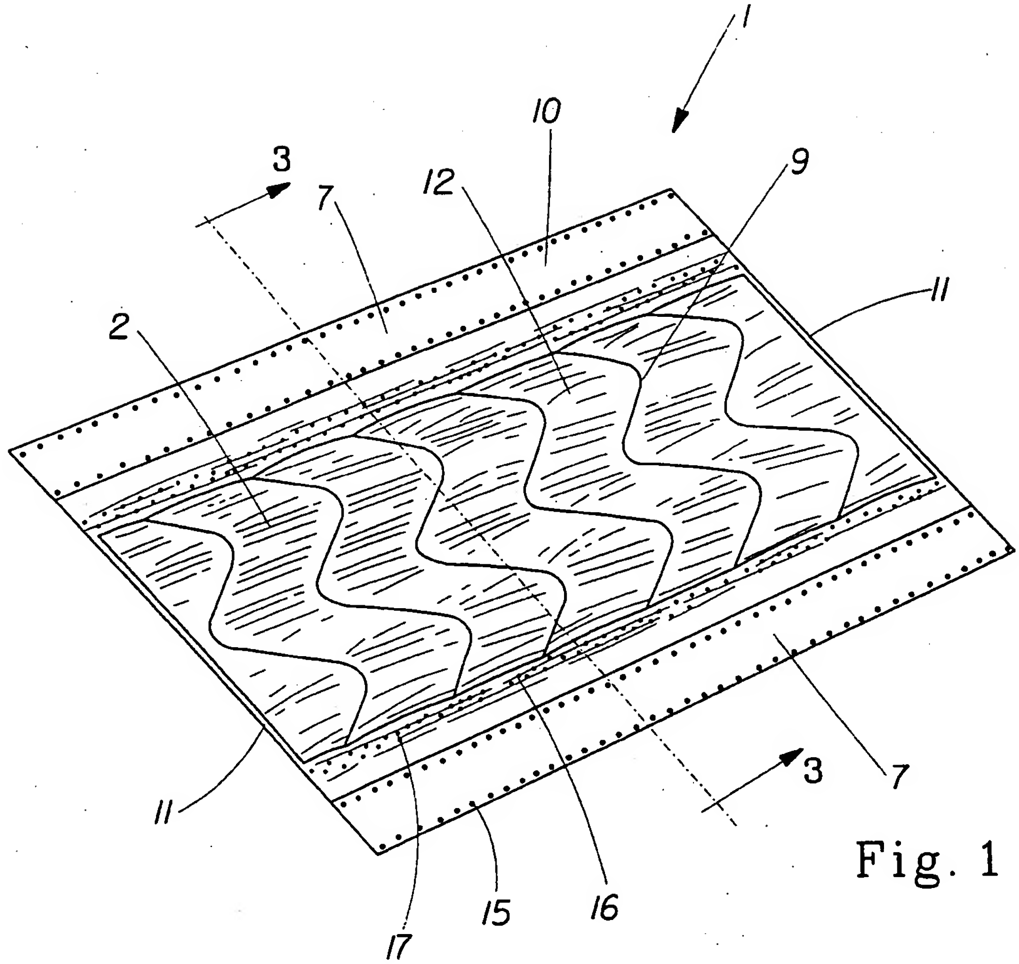
(d) cutting said second web transversely thereof along a middle line extending parallel to and between each pair of adjacent heat-seal lines so that a length of said second web corresponding to a half of the length between each pair of adjacent cutting lines defines said brushy filaments;

(e) dipping said first and second web into a solution or dispersion of additive followed by drying

(f) cutting said first web into a desired length to obtain said cleaning sheet.

19. An article of manufacture for cleaning a surface containing particulate matter, said article characterized by comprising a cleaning sheet, preferably having an aggregate basis weight of from about $20 g/m^2$ to about $275 g/m^2$., optionally comprising an additive, preferably a wax and an oil additive, packaged in a container and informational indicia in association with said container; wherein said informational indicia comprises an instruction to clean said surface by wiping said cleaning sheet across said surface to form a pile of said particulate matter and pressing said cleaning sheet down onto said pile of particulate matter.

20. The article of manufacture of Claim 19, wherein said informational indicia are selected from the group consisting of a set of worded instructions, a series of pictograms, and combinations thereof.


1
10
3
12
9
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11
2
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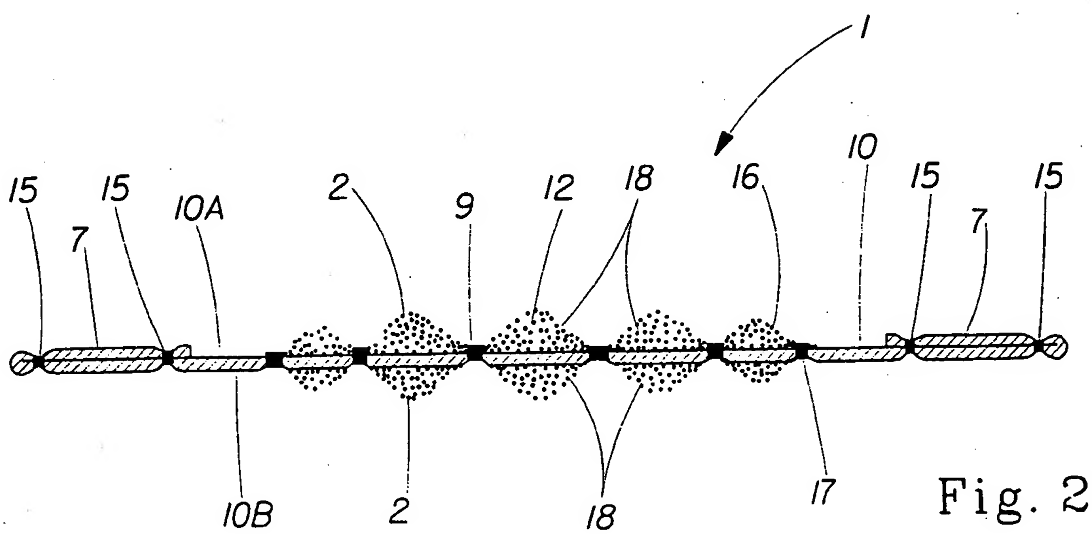
16
17

Fig. 1


1
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15
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10A
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10B
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17

Fig. 2

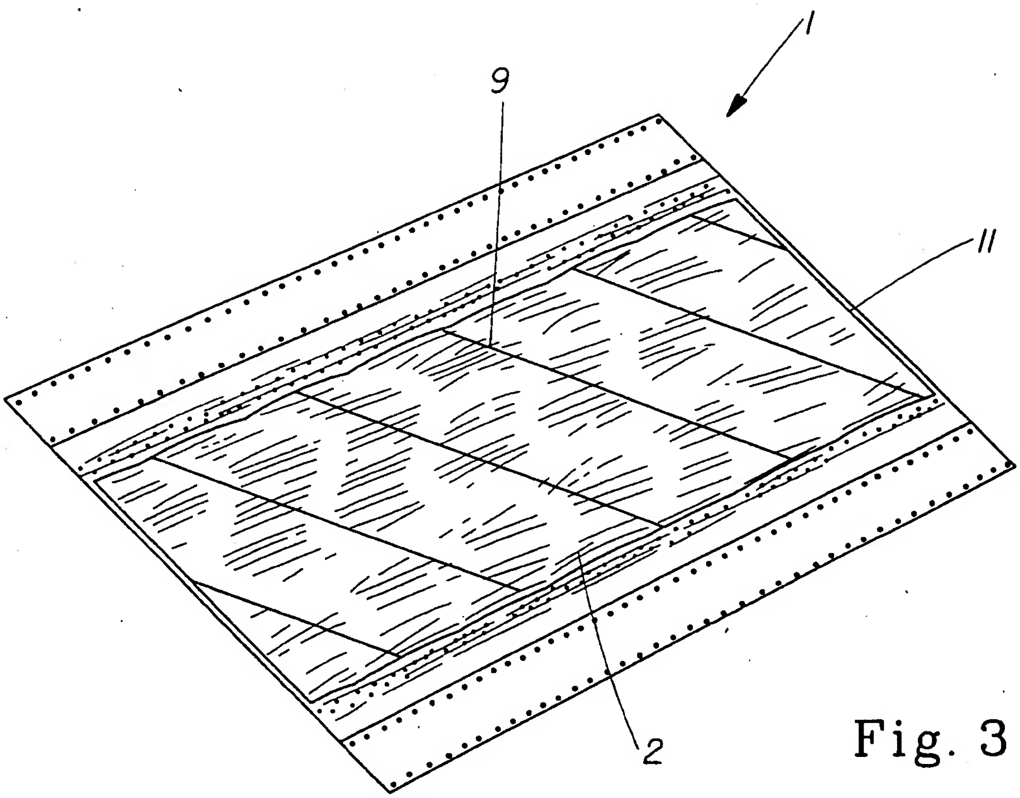

Fig. 3

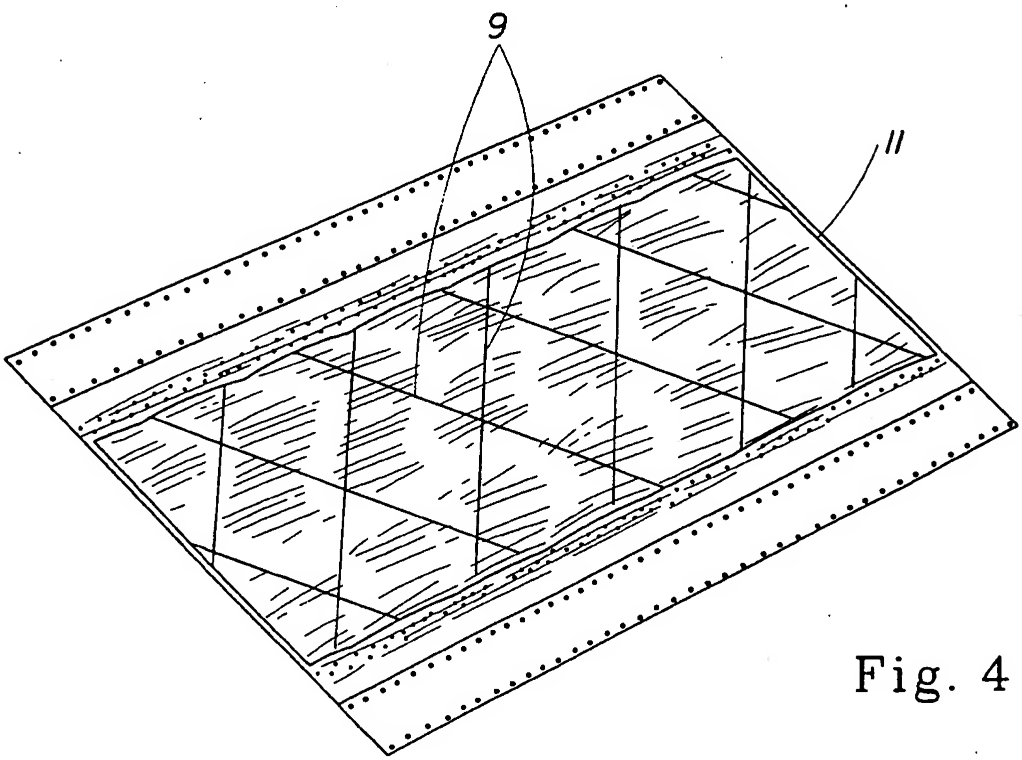

Fig. 4

Fig. 5

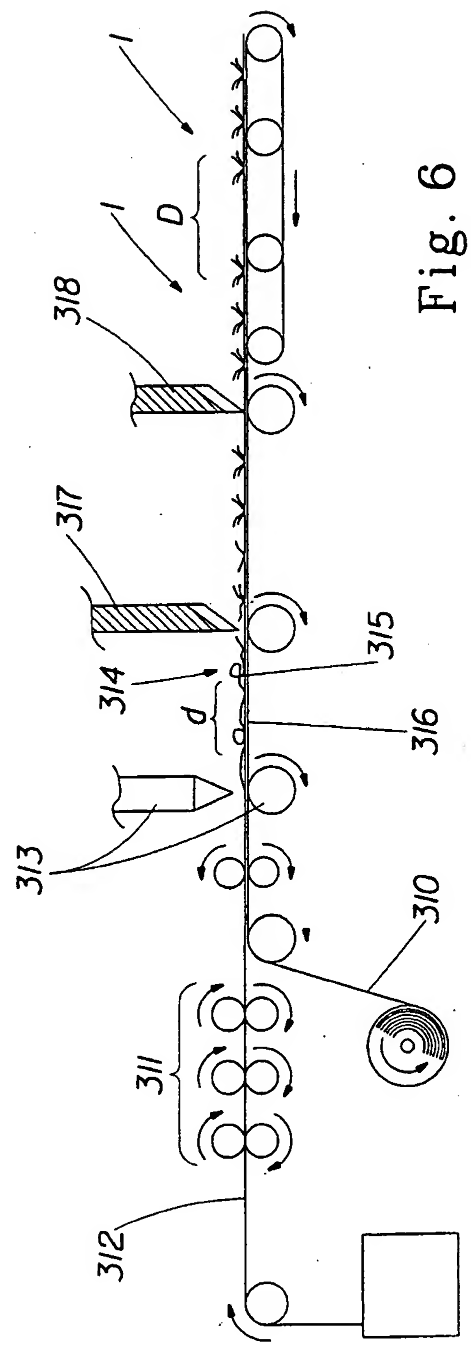

Fig. 6

Fig. 7

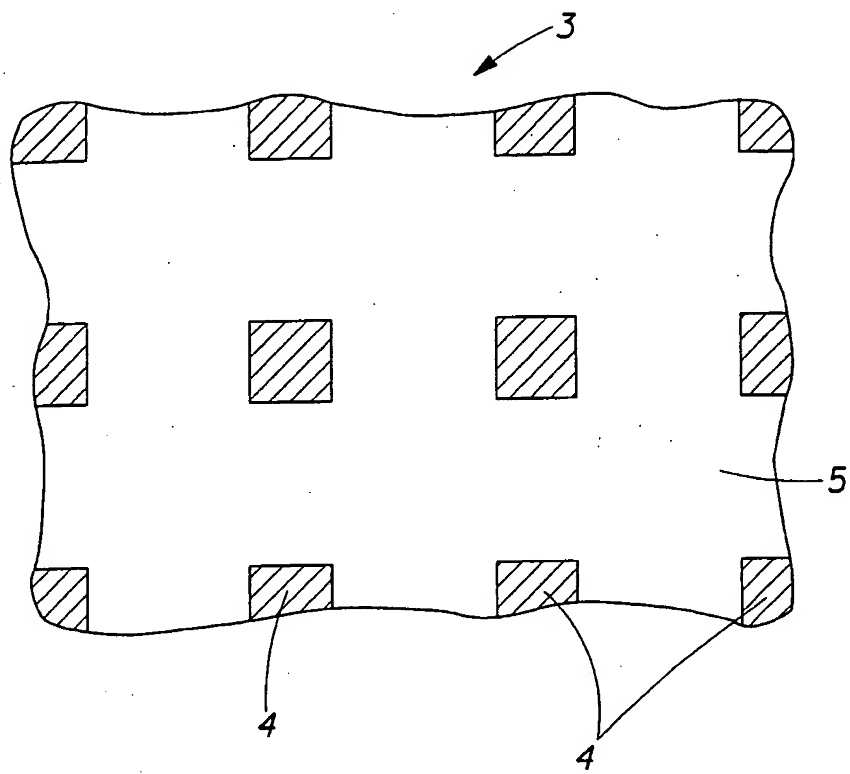

Fig. 8

INTERNATIONAL SEARCH REPORT

Intern ial Application No
PCT/US 00/21895

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C11D17/04 C11D3/18 C11D7/24 A47L13/17

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C11D A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 683 001 A (FLOYD DAVID T ET AL) 28 July 1987 (1987-07-28) column 4, line 7 -column 58; claims 1-13	1-5,8, 10-12
X	CA 1 073 310 A (TCHAGHLASSIAN JEAN) 11 March 1980 (1980-03-11) page 1, line 30 -page 2, line 15; claims	1-5
Y	DE 30 09 585 A (FREUDENBERG CARL FA) 1 October 1981 (1981-10-01) claims; examples	1-15,18
Y	EP 0 923 902 A (UNI CHARM CORP) 23 June 1999 (1999-06-23) the whole document	1-15,18

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
5 December 2000	14/12/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Grittern, A

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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A	EP 0 777 997 A (UNI CHARM CORP) 11 June 1997 (1997-06-11) cited in the application claims; figure 2	1-6,15, 17
A	US 5 599 550 A (KOHLRUSS GREGOR ET AL) 4 February 1997 (1997-02-04) cited in the application claims	1-4,7,11

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